

Figure 14 shows a block diagram of a process to form particle board.

Figure 15 shows the process utilizing a catalyst.

Figure 16 shows an alternate embodiment of the process of claim 15 where the catalyst is acid.

2. On page 15, lines 15-19, here is the paragraph marked up:

As can be seen by reference to Figure 2, one method of modifying the structure of the wood would be to introduce tri-methyl Chloro silane  $[(CH_3)_3SiCl]$  (60) to the cellulose molecule to create a modified cellulose with the carbon silicate replacing the hydroxyl group and creating an acid which can further catalyze the reaction as discussed in more detail below. This basic structural replacement lies at the heart of one embodiment of the invention.

3. On page 16, lines 10-18, here is the paragraph marked up:

Figure 6[A]a shows a less likely structure for the molecular bonding where the cellulose in the preferred embodiment may contain, by exposure within the disclosure to silicone and boron reactant molecules and solutions, a limited replacement of the hydroxyl groups with boron silicone becoming a part of the silicone chain. It is therefore one product which is claimed by the invention which is a cellulose chain modified to have bonded between hydroxyl oxygen atoms 23 boron atoms 24, silicone atoms 25 or other hydrophobic or anti-degrading elements. As can be seen by reference to Figure 6[A] a, these silicone atoms are preferably silicone atoms which have alkyl groups 26 attached to form alkyl silicates. It is taught that these alkyl groups may be varied according to the disclosure set forth below or may be replaced altogether.

4. On page 16 and 17, lines 19-22 and 1-3, here is the paragraph marked up:

As can best be seen by reference to Figure 6B, the expected end product involves the binding across the hydroxyl groups of the cellulose rings 37 of atoms or molecules (here boron or alkyl silicates) with the outer valence shells being competed across [O]xygen molecules 40 between the atoms or molecules. Figure 6[B] b also shows how it is possible that the binding would be less organized than that suggested in Figure 6a and that there may be binding across more than one hydroxyl group in a single cellulose molecule within a chain of repeating units (shown again in Figure 6[c] b as in repeating units).

5. On page 18, lines 5-13, here is the paragraphs marked up:

Figure 11 shows an alternate mechanism for the combination of silicon reagents with cellulose. In Figure 11 it can be seen that the cellulose is placed in proximity (by way of a carrier solution of the type described in more detail below) with a group [R'-Si(X)<sub>3</sub> 52] R'-Si(X)<sub>3</sub> (52) where R' is an alkyl or it's equivalent as discussed in more detail below and X is an OR group (R being a alkyl group from the same generic group as R') or a halogen or a hydroxyl group OH. This reaction shown in step B1 or B2 yields an intermediary 53 or 54 or both intermediaries. These then, in the presence of an acid or acid generated by the trimethyl chloro silane yields a more complex molecule where the silicate is combined along the carbon atoms of the cellulose as opposed to the hydroxyl groups as shown at B3.

6. On page 18 and 19, lines 22 and 1-16, here are the paragraphs marked up:

Adding a strong acid (hydrochloric, phosphoric or sulfuric acid) directly or by way of a catalyst yielding the acid in solution with the water in the wood such as methyl trichloro silane [(CH<sub>3</sub>SiCl<sub>3</sub>)] (CH<sub>3</sub>SiCl<sub>3</sub>). In the preferred embodiment this is preferably

an acid solution of .5%, but may range from 5% to .1%. It may also be outside this range with less certain results since the acidity of the wood is not desirable for most uses.

- 4) Exposing the solution prepared in steps 1-3 to cellulose to allow binding as shown with or without time and pressure restrictions to limit the extent of treatment.

The acid serves, when in contact with the water in the wood to yield ROH and  $[R\text{Si}(\text{OH})_3]$   $R\text{Si}(\text{OH})_3$  compounds. The  $[R\text{Si}(\text{OH})_3]$   $R\text{Si}(\text{OH})_3$  reacts as discussed above with the cellulose to bind in place of one or more of the hydroxyl groups 22 of the cellulose to form the hydrophobic barrier.

The compound used as a reactant may be an alkoxy group having the formula  $R\text{-Si}[(\text{OCH}_3)_3]$   $(\text{OCH}_3)_3$  (with the exact structure of the alkoxy part  $[(\text{OCH}_3)]$   $(\text{OCH}_3)$  being subject to any variation within this group of chemicals which performs the desired function shown in the drawings or its equivalent. Free boron compounds in this formulation are expected to have peak efficiency under 2% since the boron tend to counteract the hydrophobic properties of the silicates when the boron is not bound to the cellulose structure. This is an acceptable range since wood treatment generally desires .5% treatment with boron to be effective.

7. On page 20, lines 6-8, here is the paragraph marked up:

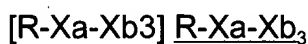
The second example (Figure 16) might employ the use of  $[B(\text{OCH}_3)_3]$   $B(\text{OCH}_3)_3$  (trimethyl borane) at any percentage depending on the amount of boron desired. In this example the importance of another acid would be minimized or even eliminated.

8. On page 24, lines 9-12, here is the paragraph marked up:

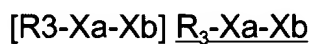
The basic chemical process includes taking the silicon and/or boron donors (or their equivalents) with three water molecules from water in the wood. In the case of boron, that would yield boric acid plus water plus  $[H_2B_4O_7]$   $H_2B_4O_7$  using of trimethyl borate or a different carbon borate. (Figures 7 and 8)

9. On page 24, lines 18-22, here is the paragraph marked up:

The basic structure of the molecules used in the process described herein include:



or



R is a carbon compound, Xa is a trivalent, tetravalent or pentavalent atom and Xb is a reactive seven valence halogen (fluorine, chlorine, bromine, etc.) or their equivalent.

10. On page 25, lines 2-8, here is the paragraph marked up:

Hence, silicon donors might be shown with the general formula  $[R-Si(X_3)]$   $\underline{R-Si(X_3)}$  This silicon donor can be represented by the general formula where X is a halogen such as chlorine, bromine, iodine, or an alkoxy group (such as methoxy, ethoxy, propoxy, butoxy or an alkoxy group with the number of carbon ranging from 3 to 20 in a straight chain or a branched chain configuration. Larger chains cause interference problems with the reactions). The X may also be a phenoxy group, a benzyloxy group or an aryloxy group in which the aromatic ring is replaced with a polycyclic aromatic ring.

11. On page 25, lines 18-21, here is the paragraph marked up:

Boron oxide  $[(B_2O_3)]$   $\underline{(B_2O_3)}$  [Other metals having a 3, 4 or 5 valence outer shell could also function in this manner.]. This chemical reacts with moisture and water within

the wood or wood products to generate Boric Acid that could be entrapped within the silicon shield (when used as a mixture with silicon donors].

12. On page 27, lines 16-19, here is the paragraph marked up:

This reaction might be shown as:

R-Si- X (here [(CH<sub>3</sub>)] (CH<sub>3</sub>)-Si-Cl<sub>3</sub>) in a solvent to yield----R-Si - (OH)<sub>3</sub> (Step A) which would subsequently react with cellulose (Step B) to form the modified cellulose chain as shown in figure 6a (Step C) plus water.

13. On pages 27-28, lines 20-22 and 1-2, here is the paragraph marked up:

Diatimathious earth, sodium silicates, or other boron or silicon salts may be used as a source of donor atoms. These may be mixed to provide intermediaries in solution which would, working together, carry out the desired end product in the wood. Examples of products having these qualities include boric acid, trimethy (trialkyl) borate, Boron Halides [(BF<sub>3</sub>, BCl<sub>3</sub>, etc.), (BF<sub>3</sub>, BCl<sub>3</sub>, etc.)] and Boric Anhydride (boron oxide).

14. On pages 15 -16, lines 20-22 and 1-5, here is the paragraph marked up:

As can be seen by reference to Figure 3, and as discussed in more detail below, the representative molecule shown in Figure 2 is a derivative of [hydroxyl] hydroxyl replacement involving the use of any compounds reactive with the [hydroxyl] hydroxyl. What is relevant to the present invention is the creation of a series of molecules from cellulose in preferably wet raw wood products and wood composite products. In Figure 3 a generic alkyl [hydroxyl] hydroxyl molecule 61 is reacted with a generic tri-alkyl halide silicate to yield (in the presence of water 64 from wood) a modified molecule 63 which is more hydrophobic and acid 65 which acid 65 can act as a catalyst to continue the reaction as described in more detail below.

15. On page 30, lines 14-21, here is the paragraph marked up.

The R group in the above silicon donor is an alkyl group ranging in a carbon chain length of 1-20 units in a straight chain or branched chain configuration. All these reagents are capable of undergoing the similar transformation as depicted in Figure- 17, [Figure -14,] or Figure 15. The reaction, the non-halogen substituted silicon reagents in this general formula react only slowly and the completion of the reaction would require a longer time, under ordinary conditions. However this process could be enhanced by the inclusion of acid or base catalysts to the silicon reagents, as shown in Figure[s] [14 and] 15. These catalysts may include, but are not limited to, a metal alkoxide or an acid such as metaphosphoric acid.

16. On page 33, lines 17-21, here is the paragraph marked up:

As can be seen by reference to Figure 13 A-C , the process of treating wood may be described as introducing a wood product 3 into a chamber 12 which opens at entry 9. The entry 9 is then closed and if desired an electromagnet field is introduced to expedite the reaction using filed generators 11 which may be magnets or ultrasound generators to obtain desired atomic alignment to enhance or restrict the reaction.

17. On page 34, lines 14-20, here is the paragraph marked up:

Figure 14 show how particles of wood 13 may be turned into particle board utilizing the process through the steps of combining the particles 13 with a glue 14 and one of the reagents (such as borax) in chamber 18 in the bottom 19 of a press. Before, after and during the compression process when the top 17 of the pump presses on a mixture of glue, wood and reagent, a solvent 16 may be introduced through a passage [70] 20 in the chamber to initiate the reaction. A pressure release valve 21 may be used to allow gases

and pressure to escape this process.

**18. On page 17 after line 12 insert (from claims 34-42):**

The method may further comprise:

1) adding to the solution at least one reactant which is an acid of sufficient strength to catalyze the reaction. This may be done by 1) adding to the solution at least one reactant which in situ produces an acid of sufficient strength to catalyze the reaction.

The step of polymerizing may comprise the step of infusing molecular donors with trivalent, tetravalent or penta valent atoms within the wood prior to the addition of the solvent.

The reactant may include at least one compound as a carbon alkyloxy and wherein the step of polymerization further comprises the steps of:

1) adding at least one acid to the solution to catalyze the polymerization.

The acid may be in solution from .1% to 10%. This acid comes from the group of compounds of the formula  $R-Xa-Xb_3$  wherein R is a carbon compound. The acid may be from the group of compounds consisting of hydrochloric acid, phosphoric acid or sulfuric acid). The carbon alkyloxy may have the formula  $R-Si(OR')_3$  wherein R and R' are alkyl groups.

19. On pages 24-25, lines 22 and line 1, here is the paragraph marked up:

R is a carbon compound, Xa is a trivalent, tetravalent or penta valent atom and Xb is a reactive [seven valence] halogen (fluorine, chlorine, bromine, etc.) or their equivalent.

**REMARKS**

**Enablement:**

Item 4a.